REMARKS

Claims 1, 3, 4, 6, 7, 10, 15, 17, 19, 20, 22, 23, and 26 are rejected under 35 USC §102(e) as being anticipated by Lee, U.S. 6,570,919.

Independent claim 1 recites an iterative equalizer for a data communication system for recovering received data transmitted over a data channel. The iterative equalizer includes a first filter for filtering received data according to first filter parameters. A combiner modifies the first filtered data with second filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data. The modified tentative decisions are modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on the received data so that intersymbol interference is removed from said modified data in a nonlinear manner.

Independent claim 17 is a method claim associated with the apparatus of claim 1.

Independent claim 15 recites an iterative equalizer for a data communication system for recovering received data transmitted over a data channel. The iterative equalizer includes a first filter for filtering received data according to first filter parameters to generate first-filtered data. A combiner modifies the first-filtered data with second-filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous

iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on an estimate of the channel parameters. The equalizer is fractionally spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data so that intersymbol interference is removed from said modified data in a nonlinear manner.

Independent claim 31 is a method claim associated with the apparatus of claim 15.

Lee '919 describes a data transmission system employs an iterative decoder that applies decision feedback equalization (DFE) to channel output samples of a packet of data. The DFE employs two filters: a feedforward filter and a feedback filter. The feedforward filter, which may be a whitened-matched filter used for detection, shifts dispersed channel output energy into the current sample. The feedback filter cancels energy of trailing inter-symbol interference from previous symbols. In each iteration by the iterative decoder, the DFE is applied to channel output samples of a packet by filtering with the feedforward filter, and then filtering with the feedback filter to cancel interference energy in the current sample from previous samples. The feedback filter uses soft information corresponding to tentative decisions for decoded data of the packet. During the first iteration, the soft information for applying DFE to the current sample is derived from the slicer output directly, and during the second and subsequent iterations the soft data of the decoder is provided to the feedback filter of the equalizer as soft information.

In contrast, the claimed iterative equalizer removes intersymbol interference (ISI) in a nonlinear manner, as recited in claims 1, 17, 15, and 31. The equalizers of claims 1, 17, 15, and 31 suppress virtually all of the ISI, including precursor and postcursor ISI, in a nonlinear

manner, significantly enhancing system performance. In fact, theory and simulations have demonstrated that the new class of equalizers can achieve a given level of reliability (as measured by bit-error rate) using significantly less received signal power than conventional equalizers. In particular, the new class of equalizers is capable of achieving a given bit error rate with 2.5 dB less received signal power as compared to a conventional system employing a minimum mean-square error DFE on severe ISI channels, even for uncoded systems.

It will be appreciated that Lee '919 is silent regarding how it is removing ISI. It is assumed that Lee '919 is not concerned in removing ISI in a nonlinear fashion. However, the invention relies on the nonlinear removal of ISI to significantly enhance system performance. Therefore, Lee '919 does not anticipate claims 1, 17, 15, and 31 and thus is allowable.

As to claims 3, 4, 6, 7, 10, 19, 20, 22, 23, and 26, they are dependent on claims 1, 15, 17, respectively. Therefore, claims 3, 4, 6, 7, 10, 15, 17, 19, 20, 22, 23, and 26 are also allowable for the same reasons argued with respect to claims 1, 15, 17 and 31.

Claims 2, 5, 14, 16, 18, 21, 28, 30 and 32 are rejected under 35 USC §103 as being unpatentable over Lee '919 in view of Ghosh, U.S. 6,011,813.

Claims 2, 5, 16, 18, 21, 28, 30 and 32 are dependent on claims 1, 17, 15, and 31, and incorporate the limitations of claims 1, 17, 15, and 31, respectively. Ghosh '813 does not address the deficiencies argued with respect to Lee '919 in claims 1 15, 17 and 31. Thus, the combination of Lee '919 and Ghosh '813 does not render claims 2, 5, 14, 16, 18, 21, 28, 30 and 32 obvious.

Claims 11 and 27 are rejected under 35 §USC 103 as being unpatentable over Lee '919.

Independent claim 11 recites an iterative equalizer for a data communication system for recovering received data transmitted over a data channel having channel parameters. The iterative equalizer includes a first filter for filtering received data according to first filter parameters to generate first-filtered data. A combiner modifies the first-filtered data with second-filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data. The modified tentative decisions are modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on an estimate of the channel parameters. The received data is encoded for error-correction coding, and the decision device comprises an error-correction decoder and further comprising an encoder for error-correction encoding the tentative decisions from a previous iteration.

Independent claim 27 is a method claim associated with the apparatus of claim 11.

Claims 11 and 27 have similar limitations recited in claims 1 and 17, respectively. However, claims 11 and 27 further recite that the first and second filter parameters are based on an estimate of the channel parameters. In addition, the received data is encoded for error-correction coding, and the decision device comprises an error-correction decoder and further comprises an encoder for error-correction encoding the tentative decisions from a previous iteration.

The arguments regarding the removing ISI nonlinearly provided herein regarding claims 1 and 17 are also applicable to claims 11 and 27. In addition, Applicants disagree that

it would be obvious to use error-detection coding and error-detection decoding given Lee 919's does not even hint or suggest the use of such coding to accomplish its task. It is quitter clear from Lee '919 that it tended its decoding scheme to minimize errors without the use of error decoding. Therefore, Lee '919 does not render obvious claims 11 and 27 because the deficiencies of Lee '813 argued in claims 1 and 17 are not obvious to one of ordinary skill.

As to claims 12 and 28, they are dependent on claims 11 and 27, respectively. Therefore, claims 12 and 28 are also allowable for the same reasons argued with respect to claims 11 and 27.

Claims 8, 13, 24, and 29 are rejected under 35 §USC 103 as being unpatentable over Lee '919 in view of Meehan, U.S. 6,115,419.

Independent claim 13 recites an iterative equalizer for a data communication system for recovering received data transmitted over a plurality of data channels having. The iterative equalizer includes a first filter for filtering received data according to first filter parameters to generate first-filtered data. A combiner modifies the first-filtered data with second-filtered data to generate modified data. A decision device generates modified tentative decisions based on the modified data. The modified tentative decisions are modified with respect to tentative decisions of a previous iteration. A second filter filters tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data. The first and second filter parameters are based on an estimate of the channel parameters. The received data comprises a plurality of received signals received over the plurality of data channels, and

the equalizer further comprises a like plurality of the first filters corresponding to the plurality of channels.

Independent claim 29 is method claim associated with the apparatus of claim 13.

Meehan '419 describes a device for improving signal reception in a signal receiver. The device comprises a beamforming circuit and decision feedback equalizer circuit. The beamforming circuit includes two branches with each circuit branch having two feedforward equalizer circuit and an adder circuit.

Claims 13 and 29 have similar limitations as claims 1 and 17, respectively. However, claim 13 and 29 further recites that the first and second filter parameters are based on an estimate of the channel parameters. In addition, the received data comprises a plurality of received signals received over the plurality of data channels, and the equalizer further comprises a like plurality of the first filter corresponding to the plurality of channels.

The arguments provided herein regarding claims 1 and 17 are also applicable to claims 13 and 29 with respect to Lee '919. Moreover, Applicants disagree that it would be obvious to have a plurality of data channels given Lee '919's deficiencies with respect to removing intersymbol interferences (ISI) in a nonlinear manner. Furthermore, Meehan '419 does not address the deficiencies of Lee '919. Therefore, the combination of Lee '919 and Meehan '419 does not render obvious claims 13 and 29 because the deficiencies of Lee '919 argued in claims 1 and 17 are not obvious to one of ordinary skill.

As to claim 14, it is dependent on claim 13. Therefore, claim 14 is also allowable for the same reasons argued with respect to claim 13.

Claims 8 and 24 are dependent on claims 1 and 17, and incorporate the limitations of claims 1 and 17, respectively. Meehan '419 does not address the deficiencies argued with respect to Lee '919 in claims 1 and 17. Thus, the combination of Lee '919 and Meehan '419 does not render claims 8 and 24 obvious.

Claims 9 and 25 are rejected under 35 §USC 103 as being unpatentable over Lee '919 in view of Agazzi, U.S. 6,236,645.

Agazzi '645 describes a communication line having a plurality of twisted wire pairs connects a plurality of transmitters, one transmitter at each end of each twisted wire pair, with a plurality of receivers, one receiver at each end of each twisted wire pair.

Claims 9 and 25 are dependent on claims 1 and 17, and incorporate the limitations of claims 1 and 17, respectively. Agazzi '645 does not address the deficiencies argued with respect to Lee '919 in claims 1 and 17. Thus, the combination of Lee '919 and Agazzi '645 does not render claims 9 and 25 obvious.

Applicants contend that claims 14 and 30, which are dependent on claims 13 and 29, are improperly rejected because the references cited to reject claims 13 and 29 are not even used to reject claims 14 and 30. Given the dependency of claims 14 and 30, they have to be rejected with at least the same references used to reject claims 13 and 29.

In view of the foregoing, Applicants respectfully submit that Ghosh '813, taken alone or in the suggested combinations, does not anticipate the invention under the provisions of 35 USC §102, nor does it support a *prima facie* case of obviousness under the provisions of 35

USC §103. Accordingly, Applicants contend that the pending claims are patentable over the prior art of record, and an early indication of same is requested.

Respectfully submitted,

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